

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP2004/011587

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G02B17/08

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G02B G03F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 31 30 239 A1 (JENOPTIK JENA GMBH)	1,2
A	16 June 1982 (1982-06-16) abstract; figure 1 -----	3,4

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

31 January 2005

Date of mailing of the international search report

21.04.2005

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Box II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-4

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-4

Claims 3-4 relate to a catadioptric projection objective as claimed in claim 1 (known from D1 = DE 31 30 239 A): in effect, D1 recites a catadioptric projection objective for projecting a pattern arranged in the object plane (see the figure (2)) into the image plane (26), having a first objective part (4) for projecting an object field lying in the object plane into a first real intermediate image (5), a second objective part (16) for generating a second real intermediate image (17) with the radiation coming from the first objective part, a third objective part (18) for generating a third real intermediate image (20) with the radiation coming from the second objective part, and a fourth objective part (22, 25) for projecting the third real intermediate image into the image plane (26).

The underlying problem to be solved is how to shorten the overall length of the projection objective.

The special structural feature is a concave mirror present in two of the objective parts.

2. claims: 5-7

Claims 5-7 relate to a catadioptric projection objective as claimed in claim 1 (known from D1, see above).

The underlying problem to be solved is how to minimize the etendue, i.e. the object is minimally off-axial.

The special structural feature is a mirror surface present in the vicinity of all intermediate images.

3. claim: 8

Claim 8 relates to a catadioptric projection objective as claimed in claim 1 (known from D1, see above).

The underlying problem to be solved is how to obtain an imaging scale different from 1 between the first real intermediate image and the object (hence introducing a chromatic magnification difference needed for further correction of asymmetrical image errors).

The special structural feature is the first objective part constructed asymmetrically.

4. claim: 9

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Claim 9 relates to a catadioptric projection objective as claimed in claim 1 (known from D1, see above).
The underlying problem to be solved is how to avoid asymmetrical errors into the first intermediate real image.
The special structural feature is the first objective part constructed symmetrically.

5. claim: 10

Claim 10 relates to a catadioptric projection objective as claimed in claim 1 (known from D1, see above).
The underlying problem to be solved is how to simplify the production of first objective part.
The special structural feature is the first objective part having two lenses the surfaces of which having the same curvature radius.

6. claim: 11

Claim 11 relates to a catadioptric projection objective as claimed in claim 1 (known from D1, see above).
The underlying problem to be solved is how to distribute the correction of field curvature and chromatism within the second and third objective parts.
The special structural features are the second and third objective parts constructed asymmetrically.

7. claim: 12

Claim 12 relates to a catadioptric projection objective as claimed in claim 1 (known from D1, see above).
The underlying problem to be solved is how to simplify the design of the second and third objective parts and obtain an imaging scale close to 1 between the third and first real intermediate images.
The special structural features are the second and third objective parts constructed symmetrically with respect to one another.

8. claim: 13

Claim 13 relates to a catadioptric projection objective as claimed in claim 1 (known from D1, see above).
The underlying problem to be solved is how to reduce the available space in a design having a first and second catadioptric objective parts with an inclined first catadioptric objective part.
The special structural feature is the optical axis of the second objective part arranged coaxially with that of the first objective part.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

9. claim: 14

Claim 14 relates to a catadioptric projection objective as claimed in claim 1 (known from D1, see above).

The underlying problem to be solved is how to increase the space between the reticle plane (object) and the mirror of the first objective part, in a design having a first and second catadioptric objective parts (to allow the use of e.g. a polarisation beam splitter).

The special structural features are the optical axes of the first and second objective parts arranged offset w.r.t. each other.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 3130239	A1	DD 153855 A1	10-02-1982
		JP 1438501 C	19-05-1988
		JP 57084038 A	26-05-1982
		JP 62041018 B	01-09-1987

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